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(54) DEVICE AND METHOD FOR IMAGE PROCESSING AND PROVIDING MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To eliminate even noise in the time direction of an image.

SOLUTION: A block forming part 1 collectively reads a prescribed quantity of image data stored in a signal delaying part 2 and outputs them to a plane estimating part 3. The part 3 calculates the expression for a plane where a signal level value is decided as constant by successively substituting inputted image data. A constancy direction evaluating part 4 stores plural classes classified according to the existence positions of five prescribed pixels and successively substitutes the coordinate values of the five pixels into the calculated plane expression for each class to calculate the dynamic range of each class. It outputs a class with the smallest dynamic range to a predictive tap forming part 5 and a predictive coefficient ROM 6. The part 5 and the ROM 6 output data corresponding to the inputted class to a prediction processing part 7. The part 7 performs adaptive processing for noise elimination based on the inputted data.

CLAIMS

[Claim(s)]

[Claim 1]An image processing device comprising:

A blocking means which blocks picture element data in which a noticed picture

element comprises the field of a specified number where said standard field is located in a front or the back in time including the standard field located in the center.
A flat-surface estimation means which presumes a flat surface judged that substitute for a predetermined formula picture element data blocked by said blocking meansand a level value is the same.
A calculating means which computes a dynamic range for every class by substituting a coordinate value of two or more pixels set as a flat-surface type presumed by said flat-surface estimation means for every classand taking a difference of the minimum and the maximum.
A reading means which reads a prediction coefficient corresponding to a class with the minimum of a dynamic range computed by a memory measure which memorizes a prediction coefficient set up for said every classand said calculating means from said memory measureAn adaptive processing means to perform adaptive processing using a prediction tap which consists of said prediction coefficient read by said reading means and a predetermined pixel.

[Claim 2]When coordinates of other pixels within said block were expressed for coordinates of said noticed picture element as = (level xvertical ytime z) (000)r and the remainder are set to e and a coefficient is set to c1 thru/or c4 for a signal levelThe image processing device according to claim 1 to which a predetermined formula of said flat-surface estimation means is expressed as r+e=c1x+c2y+c3andz+c4and said flat-surface estimation means is characterized by presuming a flat surface that said remainder e serves as the minimum with a least square method.
[Claim 3]The image processing device according to claim 1wherein said adaptive processing means calculates data from which a noise of said noticed picture element was removed by linear combination of said prediction tap and said prediction coefficient.
[Claim 4]The image processing device according to claim 1 detecting a motion of a picture displayed with said picture element data from a class with the minimum of a dynamic range computed by said calculating means.
[Claim 5]A blocking step which blocks picture element data in which a noticed picture element comprises the field of a specified number where said standard field is located in a front or the back in time including the standard field located in the centerA flat-surface estimating step which presumes a flat surface judged that substitute for a predetermined formula picture element data blocked at said blocking stepand a level value is the sameA calculation step which computes a dynamic range for every class by substituting a coordinate value of two or more pixels set as a flat-surface type presumed by said flat-surface estimating step for every classand taking a difference of the minimum and the maximumA memory step which memorizes a prediction coefficient set up for said every classA read-out step which reads a prediction coefficient corresponding to a class with the minimum of a dynamic range computed at said calculation step from said memory

stepAn image processing method containing an adaptive processing step which performs adaptive processing using a prediction tap which consists of said prediction coefficient read at said read-out stepand a predetermined pixel.
[Claim 6]A blocking step which blocks picture element data in which a noticed picture element comprises the field of a specified number where said standard field is located in a front or the back in time including the standard field located in the centerA flat-surface estimating step which presumes a flat surface judged that substitute for a predetermined formula picture element data blocked at said blocking stepand a level value is the sameA calculation step which computes a dynamic range for every class by substituting a coordinate value of two or more pixels set as a flat-surface type presumed by said flat-surface estimating step for every classand taking a difference of the minimum and the maximumA memory step which memorizes a prediction coefficient set up for said every classA read-out step which reads a prediction coefficient corresponding to a class with the minimum of a dynamic range computed at said calculation step from said memory stepA distribution medium providing a program which a computer which makes an image processing device perform processing containing an adaptive processing step which performs adaptive processing using a prediction tap which consists of said prediction coefficient read at said read-out step and a predetermined pixel can read.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]Especially this invention is used for removing the noise which exists in the time direction in image data about an image processing devicea methodand a distribution mediumand relates to a suitable image processing devicea methodand a distribution medium.
[0002]
[Description of the Prior Art]Although the noise component of image data is removed conventionallymotion detection of a picture is performedand it is made to perform filtering processing of a time direction to the portion (pixel group) judged to fully stand it still.
[0003]
[Problem(s) to be Solved by the Invention]Howeverin the solvent wiping removal of the noise component mentioned abovewhen superimposed on the noise componentthe technical problem of right motion detection becoming impossible and as a result removal of a right noise component becoming impossible occurred.
[0004]Although a noise component is controlled to the imaging range judged to fully stand it still in the solvent wiping removal of a noise component mentioned aboveWhen it is going to control a noise component also to a moving image areain order for smoothing in uniform (not structurally based on the attribute of

immobilization or a main picture) space to perform noise rejection processing (in order to remove a changeful portion as a noise)The technical problem that it will be accompanied by degradation of the space resolutions of a main picture occurred.

[0005]This invention is made in view of such a situationand in the field of predetermined number of sheetsAs the flat surface judged that a signal level is the same is presumedit is the presumed flat surface and inclination judges one way used as 0and adaptive processing is performed so that a noise may be removed in the directiondegradation of space resolutions is controlled.

[0006]

[Means for Solving the Problem]A blocking means in which the image processing device according to claim 1 blocks picture element data in which a noticed picture element comprises the field of a specified number where the standard field is located in a front or the back in time including the standard field located in the centerA flat-surface estimation means which presumes a flat surface judged that substitute for a predetermined formula picture element data blocked by blocking meansand a level value is the sameA calculating means which computes a dynamic range for every class by substituting a coordinate value of two or more pixels set as a flat-surface type presumed by a flat-surface estimation means for every classand taking a difference of the minimum and the maximumA reading means which reads a prediction coefficient corresponding to a class with the minimum of a dynamic range computed by a memory measure which memorizes a prediction coefficient set up for every classand calculating means from a memory measureIt has an adaptive processing means to perform adaptive processing using a prediction tap which consists of a prediction coefficient read by reading means and a predetermined pixel.

[0007]The image processing method according to claim 5 includes the standard field where a noticed picture element is located in the centerA blocking step which blocks picture element data which comprises the field of a specified number where the standard field is located in a front or the back in timeA flat-surface estimating step which presumes a flat surface judged that substitute for a predetermined formula picture element data blocked at a blocking stepand a level value is the sameA calculation step which computes a dynamic range for every class by substituting a coordinate value of two or more pixels set as a flat-surface type presumed by a flat-surface estimating step for every classand taking a difference of the minimum and the maximumA read-out step which reads a prediction coefficient corresponding to a class with the minimum of a dynamic range computed at a memory step which memorizes a prediction coefficient set up for every classand a calculation step from a memory stepAn adaptive processing step which performs adaptive processing using a prediction tap which consists of a prediction coefficient read at a read-out step and a predetermined pixel is included.

[0008]A blocking step to which the distribution medium according to claim 6 blocks picture element data in which a noticed picture element comprises the field

of a specified number where the standard field is located in a front or the back in time including the standard field located in the centerA flat-surface estimating step which presumes a flat surface judged that substitute for a predetermined formula picture element data blocked at a blocking stepand a level value is the sameA calculation step which computes a dynamic range for every class by substituting a coordinate value of two or more pixels set as a flat-surface type presumed by a flat-surface estimating step for every classand taking a difference of the minimum and the maximumA read-out step which reads a prediction coefficient corresponding to a class with the minimum of a dynamic range computed at a memory step which memorizes a prediction coefficient set up for every classand a calculation step from a memory stepA program which a computer which makes an image processing device perform processing containing an adaptive processing step which performs adaptive processing using a prediction tap which consists of a prediction coefficient read at a read-out step and a predetermined pixel can read is provided.

[0009]In the image processing device according to claim 1the image processing method according to claim 5and the distribution medium according to claim 6Picture element data of a block which comprises the field of a specified number is substituted for a predetermined formulaIt is presumed by flat surface judged that a level value is the sameand at a flat-surface ceremony of the presumed flat surface. A coordinate value of two or more pixels set up for every class is substitutedand a dynamic range for every class is computed by taking a difference of the minimum and the maximumA prediction tap which consists of a prediction coefficient corresponding to a class with the minimum of a dynamic range and a predetermined pixel is usedand adaptive processing is performed.

[0010]

[Embodiment of the Invention]Although an embodiment of the invention is described belowit is as followswhen an embodiment [/ in the parenthesis after each means] (howeveran example) is added and the feature of this invention is describedin order to clarify correspondence relation between each means of an invention given in a claimand following embodiments. Howeverof coursethis statement does not mean limiting to what indicated each means.

[0011]The image processing device according to claim 1 includes the standard field where a noticed picture element is located in the centerThe blocking means (for exampleblock formation part 1 of drawing 1) which blocks the picture element data which comprises the field of a specified number where the standard field is located in a front or the back in timeThe flat-surface estimation means (for examplestep S3 of drawing 2) which presumes the flat surface judged that substitute for a predetermined formula the picture element data blocked by the blocking meansand a level value is the sameThe coordinate value of two or more pixels set as the flat-surface type presumed by the flat-surface estimation means for every class is substitutedThe calculating means (for examplestep S4 of drawing 2) which computes the dynamic range for every class by taking the difference of the minimum and the maximumThe memory measure (for

exampleprediction coefficient ROM6 of drawing 1) which memorizes the prediction coefficient set up for every classThe reading means (for examplestep S5 of drawing 2) which reads the prediction coefficient corresponding to a class with the minimum of the dynamic range computed by the calculating means from a memory measureIt has an adaptive processing means (for examplestep S6 of drawing 2) to perform adaptive processing using the prediction tap which consists of a prediction coefficient read by the reading means and a predetermined pixel.

[0012]Drawing 1 is a block diagram showing the composition of the 1 embodiment of the image processing device which applied this invention. An input SD (Standard Definition) signal is supplied to the signal delaying section 2 which comprises FIFO (First In First Out) etc. via the block formation part 1. The SD signal inputted into the signal delaying section 2 is blocked and read to the block formation part 1 if neededand is outputted to the flat-surface estimating part 3. The signal outputted from the flat-surface estimating part 3 is outputted to the direction evaluating part 4 of stationarity.

[0013]The signal outputted from the direction evaluating part 4 of stationarity is outputted to prediction tap formation part 5 and prediction coefficient ROM(Random Access Memory) 6. With the prediction coefficient memorized by prediction coefficient ROM6 in the signal outputted from the prediction tap formation part 5the forecast processing part 7 performs predetermined processingand outputs it as an SD signal after processing.

[0014]Nextoperation of an image processing device is explained with reference to the flow chart of drawing 2. In Step S1via the block formation part 1an SD signal (for exampleluminance signal of 8-bit PCM (Pulse Code Modulation)) is inputted into the signal delaying section 2and is memorized. In Step S2the block formation part 1 reads the SD signal (image data) of the specified quantity memorized by the signal delaying section 2. The data of the specified quantity read is data of the predetermined field of each field of the data for a total of nine fields which comprise the 1st field (for exampleodd number field) of five sheetsand the 2nd field (for exampleeven number field) of four sheetsas shown in drawing 3 (A). In this examplesince it is easyas shown in drawing 3 (B)the field of the 1st field shall comprise 45 (=9x5) pixeland the field of the 2nd field shall comprise 36 (=9x4) pixel. Thereforethe total pixel number of the field for the 9 fields read from the signal delaying section 2 will be 369 pixels. The 9 fields which consist of these 369 pixels are hereafter described suitably to be the blocks between local space-time.

[0015]A paraphrase will constitute the block between local space-time from a total of nine fields of the 4 fields where the standard field is located in a front or the back in time including the standard field where the noticed picture element made into the processing object is located in the center of a field. The field of the standard field is the field horizontally constituted from 5 pixels by 9 pixels and the perpendicular direction. When the coordinate value of the time base direction of the standard field is set to 0the coordinate value (time) of the time base direction of the field which exists in front in time than the standard field is expressed with minusand the coordinate value (time) of the time base direction of the field which

exists behind in time than the standard field is expressed with plus. Thereforethe coordinate value (time) of a time base direction changes to −4 thru/or 4. The coordinates between space−time of a noticed picture element are shown as followsthese coordinates are made into the starting pointand the coordinates of other pixels are expressed.

(Levelperpendicularitytime) =(xyz) = (000)

[0016]The block formation part 1 reads the data of the block between [of one] local space−time from the signal delaying section 2 collectivelyand outputs it to the flat−surface estimating part 3. The flat−surface estimating part 3 substitutes all the inputted picture element data of the block between local space−time for a following formula (1).

r_n+e=c1x_n+c2y_n+c3andz$_n$+c4 ... (1)

space−time [in / on a formula (1) and / in r_n / a noise picture (input SD picture)] −− a spacer −− the mark (level.) Perpendicularity and time are the luminance−signal values of the picture element data of ($x_n y_n z_n$)it is a coordinate value with which e considers it as the remainder and ($x_n y_n z_n$) make the starting point the noticed picture element of the level of the n−th pixel within the block between space−timeperpendicularityand timeand c1 thru/or c4 are coefficients.

[0017]The flat−surface estimating part 3 calculates the coefficients c1 thru/or c4 so that luminance−signal value r_n and the coordinate value of picture element data of the inputted picture element data of the block between local space−time ($x_n y_n z_n$) may be substituted for a formula (1) and the sum of squares of the remainder e shown in a following formula (2) may serve as the minimum.

[Formula 1]

[0018]In the case of the example of drawing 3 (A)the value m in a formula (2) is set to 368. When making the calculated coefficient into c1' thru/or c4'the flat−surface type showing in a formula (3) is generated.

r=c1'x+c2'y+c3'andz+c4' ... (3)

[0019]Thusthe flat surface generated by the formula (3) expressed using coefficient c1' thru/or c4' called for by the flat−surface estimating part 3 is made into a presumed flat surface. An example of this presumed flat surface is shown in drawing 4. The presumed flat surface shown in drawing 4 is a flat surface generated by the formula (3)and they are not necessarily a flat surface generated by the pixel which actually exists in the block between local space−timeand the flat surface where the pixel of the block between local space−time is on the presumed flat surface if it puts in another way. When it furthermore puts in another wayit is a flat surface which exists in the position in which the pixel judged that a presumed flat surface has the almost same signal level (luminance value) probably exists.

[0020]In the horizontal direction of the field which consists of a perpendicular direction and a horizontal direction when a presumed flat surface as shown in drawing 4 is presumedIn [a vertical coordinate value falls from the left−hand side

to right-hand sideand] a time directionWhen the flat surface which does not have change in a vertical coordinate value is presumed to be levelit applies to the lower left side from the figure Nakamigi upper partand a luminance value will fall gradually or the picture which goes up (as [start / gradation]) will be displayed not changeful during the time for the 9 field.
[0021]The presumed flat surface shown in drawing 4 is expressing the ** level surfaceis not expressing the level of the signal itselfand has shown it as a thing like the contour line of the level value of a signal.
[0022]When changing steeply on stairs besides that from which a luminance value changes gradually about the previous direction of space as other examples presumed flat surfaces as shown in drawing 4 are presumed to beit is a picture which presents a certain luminance value change in the direction which intersects perpendicularly with a presumed flat surface.
[0023]Nextthe direction evaluating part 4 of stationarity is carried out in this wayit is contained at the presumed flat surface expressed using coefficient c1' thru/or c4' called for by the flat-surface estimating part 3and an inclination searches for the direction of 0 (the regular direction) about the direction of one dimension at least. The direction of the inclination 0 called for becomes a one-dimensional or two-dimensional functionfor examplethe linear expressions expressed by f(x) or f (xy). In the case of the picture which becomes stair-likethe regular direction searched for turns into the direction of the step of the stairsa direction which will rise and fall stairs if it puts in another wayand a direction which intersects perpendicularlywhen the luminance value mentioned above is plotted as it was.
[0024]The direction evaluating part 4 of stationarity also performs class sorting while searching for the regular direction. A paraphrase will judge the regular direction based on a class. That isthe conditions for being beforehand classified into two or more class and each class are definedand stationarity is judged by into which class it is classified. As conditions for being classified into each classit calls at the existence position of 5 pixels predetermined [of the 369 pixels contained in the 9 field].
[0025]In this casethe total number of classes serves as a class of a ${}_{369}C_5$ individual. Howeversince the class of a ${}_{369}C_5$ individual becomes the huge number of combinationit is not practical. Thenif the number of classes is considered using 5 pixels from predetermined 21 pixels (it is hereafter described as a selected candidate pixel suitably) of the 1st field of five sheets as shown in drawing 5it will become a ${}_{21}C_5$=20349 piece classand will become the number of classes which is easy to deal with it. Since 4 pixels will be chosen from 20 pixels of a selected candidate pixel by adding the conditions that a noticed picture element is certainly includedit becomes a ${}_{20}C_4$=4845 piece classand becomes the number of classes which is easier to deal with it.
[0026]In the example shown in drawing 5in all the directions about the oblique direction in every direction containing a noticed picture element17 pixels of the selected candidate pixel in the standard field are arranged so that 5 pixels can be chosen. and in the field before and behind the standard fieldonly the coordinate

values of a noticed picture element and a time-axis differ -- four pointsif it puts in another waylet the four points with same noticed picture elementperpendicular directionand horizontal coordinate value be a selected candidate pixel.
[0027]In the example of drawing 5although only the pixel which exists in the 1st field is usedthe pixel which exists in the 2nd field may be used as a selected candidate pixeland it is good also considering a pixel of 21 pixels or more as a selected candidate pixel. That isalthough it is best to consider it as 396 pixels which is all the pixels in 9 fields as a selected candidate pixelsince it is not practical as mentioned aboveit is a practical number and it is desirable to make as many pixels as possible into a selected candidate pixel.
[0028]4845 classes can be created if a class is created using the 21-pixel selected candidate pixel containing a noticed picture element. The class 0the class 4844 (class of the very first and the last)and the class 152 and the class 2088 that are characteristic classes are shown in drawing 6 as an example among 4845 classes. How to attach a class number is based in order of the scan. For examplethe pixel of the coordinate value (00-4) with which the class 0 is scanned by the beginning among 21 pixels of a selected candidate pixelIt is a total of 5 pixels of the pixel of the coordinate value (00-2) scanned by the nextthe pixel of the coordinate value (-4-40) further scanned by the nextthe pixel of the coordinate value (0-40) scanned by the nextand the noticed picture element of a coordinate value (000).
[0029]Similarlythe classes 0 thru/or 4844 are generated by attaching a class number based on the order of a scan. The class 152 is a class according to which the picture from which stationarity is most acquired for the regular direction in a time base direction is classifiedfor example like a still picture. The class 2088 is a class according to which the picture from which stationarity is acquired most is classified into the oblique direction in an identical field like a picture which one line has lengthened aslant on the white groundfor example.
[0030]The direction evaluating part 4 of stationarity substitutes the coordinate value of 5 pixels in the class 0 thru/or 4844 one by one at the formula (3) of the presumed flat surface first searched for by the flat-surface estimating part 3and takes the difference (dynamic range) of the minimum of the value rand the maximum computed every 5 pixels. And let the class which has the minimum dynamic range among the dynamic ranges obtained for every class be a classification class of the block between local space-time currently processed. Howeverthe value r which carries out such and is computed in the direction evaluating part 4 of stationarity does not mean a luminance valueand is used as a value for only computing a dynamic range.
[0031]The five values r are obtained by first substituting the coordinate value of 5 pixels of the class 0i.e.(00-4)(00-2)(-4-40)(0-40)and (000) one by one for explaining in detail at a formula (3). The dynamic range of the class 0 is obtained by taking the acquired difference of the minimum of the five values rand the maximum. By performing same processing also to the classes 1 thru/or 4844a total of 4845 dynamic ranges are obtained. The class which has the minimum

dynamic range among these 4845 dynamic ranges is determined as a class (a classification class is called hereafter) of the pixel currently processed. When the class whose dynamic range is 0 exists temporarily5 pixels of the class mean existing on the presumed flat surface expressed with a formula (3).
[0032]Thusthe called-for classification class is supplied to prediction tap formation part 5 and prediction coefficient ROM6. In Step S5the prediction tap formation part 5 reads the picture element data of the prediction tap corresponding to the supplied classification class from the signal delaying section 2and outputs it to the forecast processing part 7. Prediction coefficient ROM6 outputs the prediction coefficient corresponding to the supplied classification class to the forecast processing part 7. As a prediction tapas shown in drawing 65 pixels which was used for judging the regular direction and which was set up for every class are used. Thereforethe picture element data which the prediction tap formation part 5 reads from the signal delaying section 2 is picture element data (luminance value) which exists in the position corresponding to the coordinate value of 5 pixels of a classification class.
[0033]In Step S6adaptive processing of the forecast processing part 7 is carried out using the prediction coefficient and picture element data which were suppliedand it outputs the picture element data after processing. Adaptive processing is processing which calculates the primary linearity coupled models shown in the formula (4) later mentioned using the picture element data of the prediction coefficient corresponding to the class of the noticed picture elementand a prediction tap.
[0034]As mentioned abovein an image processing deviceadaptive processing of the input SD picture is carried out using the prediction coefficient beforehand memorized by prediction coefficient ROM6 for every class. Herethe prediction coefficient learning device which generates the prediction coefficient memorized by prediction coefficient ROM6 is explained.
[0035]Drawing 7 is a block diagram showing the composition of a prediction coefficient learning device. The block formation part 21the signal delaying section 22the flat-surface estimating part 23the direction evaluating part 24 of stationarityand the prediction tap formation part 25It has the same function as the block formation part 1the signal delaying section 2the flat-surface estimating part 3the direction evaluating part 4 of stationarityand the prediction tap formation part 5 of the name with which drawing 1 correspondsand the explanation is omitted suitably.
[0036]As mentioned aboveclass sorting of the SD signal inputted into the prediction coefficient learning device is carried out by the block formation part 21the signal delaying section 22the flat-surface estimating part 23and the direction evaluating part 24 of stationarity. A prediction coefficient is computed by the prediction coefficient learning part 26 to a classification class. Hereafterthe calculation of a prediction coefficient performed by the prediction coefficient learning part 26 is explained.
[0037]The input data x1 of the pixel (a noticed picture element is included) in the

position which approaches the predicted value E [y] of picture-element-data y of now and a noticed picture element spatially or in time with the noticed picture elementx2x3and ...When asking by the primary linearity coupled models specified by the linear combination of the predetermined prediction coefficient w1w2w3and ...the predicted value E [y] can be expressed with a following formula.
E [y] =w1x1+w2x2+w3x3+ ...... (4)
[0038]The procession Y which becomes by the procession X which becomes as an example accepted [the formula (4)] by the procession W which becomes by set of the prediction coefficient wand input data xand set of predicted value E [y]
[Equation 2]

A definition will form an observation equation like a following formula (5).
Observation equation: XW=Y ... (5)
[0039]And it considers asking this observation equation for the predicted value E [y] near picture-element-data y of a noticed picture element with the application of a least square method. In this casethe procession E which becomes by set of the remainder e of predicted value E [y] to procession Y' which becomes by set of true picture-element-data y of the noticed picture element used as teacher dataand picture-element-data y [Equation 3]

If a definition is come out and givena remainder equation (6) like a following formula will be materialized from an equation (5).
Remainder equation: XW=Y+E ... (6)
[0040]Although teacher data is a reference SD picture and is an input SD signal and an identical contentit is a non-noise picture without a noise component.
[0041]Prediction coefficient w_i for calculating the predicted value E [y] near picture-element-data y is a square error. [Equation 4]

It can ask by using the minimum. Thereforeprediction coefficient w_ii.e.prediction coefficient w_i which fills a following formula (7)in case what differentiated this square error from prediction coefficient w_i is set to 0 will call it the optimum value for calculating the predicted value E [y] near picture-element-data y.
[Equation 5]

[0042]Thena following formula (8) is first materialized by differentiating a formula (6).
[Equation 6]

[0043]A following formula (9) is obtained from a formula (7) and a formula (8).

[Equation 7]

[0044]If picture-element-data [of learned data x in the remainder equation of an equation (6)the prediction coefficient wand teacher data] y and the relation of the remainder e are taken into considerationthe following normal equations (10) can be obtained from an equation (9).
[0045]
[Equation 8]

[0046]Since the normal equation of an equation (10) can build only the same number as the number of the estimated coefficients w which should be calculatedit can calculate the optimal prediction coefficient w by solving an equation (10). In solving a formula (10)it is possible to sweep out and toapply law (elimination of Gauss-Jordan) etc. for example.
[0047]Thusthe calculated prediction coefficient w is related with a class (prediction tap)and is memorized by prediction coefficient ROM6 (drawing 1). The forecast processing part 7 performs adaptive processing to a noticed picture element by primary linearity coupled models shown in a formula (4) using the number w of reservations clerks which can ask as mentioned aboveand is memorized by number ROMof **** reservations clerks 6.
[0048]Thusan example of a computed prediction coefficient is shown in drawing 8. A prediction coefficient of the class 152 and the class 2088 is shown in drawing 8. It becomes possible by substituting picture-element-data y corresponding to such the prediction coefficient w and a prediction tap for a formula (4) to obtain picture element data from which a noise was removed.
[0049]In this embodimentsince class sorting adaptation processing was used about the regular direction judged that a level value is equalit becomes removable [the optimal noise for an animation and a still picture].
[0050]In explanation mentioned abovealthough this invention was applied about noise rejectionapplying also to motion detection is possible. That iswhen carrying out class sorting of this inventionit presumes a flat surface judged that a level value is equaland judges the regular direction further. When the regular direction of this is the direction of the upper right about a time directionfor exampleit is shown that it is possible to judge that a photographic subject of the picture is moving in the direction of upper right.
[0051]Thereforeit is possible to detect the motion direction of a photographic subject by a classification class. Since the regular direction can be judged using data in the state where a noise got also to a picture in which a noise was when this embodiment is used for motion detectionmotion detection which cannot be easily influenced by a noise becomes possible.
[0052]A transmission medium by networkssuch as the Interneta digital satelliteetc. besides information recording mediasuch as a magnetic disk and CD-ROMis also

contained in a distribution medium which provides a user with a computer program which performs the above-mentioned processing in this specification.
[0053]
[Effect of the Invention]According to the image processing device according to claim 1the image processing method according to claim 5and the distribution medium according to claim 6like the above. The picture element data of the block which comprises the field of a specified number is substituted for a predetermined formulaPresume the flat surface judged that a level value is the sameand at a flat-surface ceremony of the presumed flat surface. Substitute the coordinate value of two or more pixels set up for every classand the dynamic range for every class is computed by taking the difference of the minimum and the maximumSince it was made to perform adaptive processing using the prediction tap which consists of a prediction coefficient corresponding to a class with the minimum of a dynamic rangeand a predetermined pixelit becomes possible to remove a noise component suitable for an animation and a still picture.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a block diagram showing the composition of the 1 embodiment of an image processing device with the application of this invention.
[Drawing 2]It is a flow chart explaining operation of the image processing device shown in drawing 1.
[Drawing 3]It is a figure explaining the block between space-time.
[Drawing 4]It is a figure explaining a presumed flat surface.
[Drawing 5]It is a figure explaining a selected candidate pixel.
[Drawing 6]It is a figure showing an example of a class and a prediction tap.
[Drawing 7]It is a block diagram showing the composition of a prediction coefficient learning device.
[Drawing 8]It is a figure showing an example of a class and a prediction coefficient.
[Description of Notations]
1 A block formation part and 2 [Prediction coefficient learning part] A signal delaying section and 3 A flat-surface estimating part and 4 The direction evaluating part of stationarity5 prediction-tap formation part6 prediction-coefficient ROMseven forecast processing partsand 26
